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Foot Care Knowledge, Practice and Self-Efficacy of People with Type 2 Diabetes, With and Without Lower Limb Ulceration

By

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in partial fulfillment of the requirements for the degree of

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Dedication

I dedicate this thesis to my husband Myron and my children Wes, Ali and Jill. Without their unconditional love, support, encouragement and self-sacrifice, I would never have been able to accomplish so much or come so far. Completion of this life goal is one of my proudest moments. However, moments pass and in their wake are left fond memories, love and respect for those who mean so much and an ever present sense of belonging to something important...family. Thank you.

Abstract

A study was undertaken to compare the self foot-care knowledge, practice and self-efficacy of two groups of people with type 2 diabetes; those with and without lower extremity ulceration. Self-report surveys were administered and individual health history and lower limb assessment were completed. Ulceration risk was assessed and ulcerations were graded. Age and gender were significant with the ulceration group being older and mostly men. No overall differences in self foot-care knowledge or self-efficacy scores were found, with self foot-care practice scores approaching significance. Except for footwear, an adequate level of knowledge, practice and efficacy were reported for both groups. Interpreting questions regarding footwear may have been problematic. However, given poor fit and condition of footwear in the ulceration group, deficiencies in knowledge and practice may truly exist, with overestimation of confidence. These small, single-center, convenience sample, results offer some descriptive insight and may provide direction for future self care education of patients with type 2 diabetes.

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Chapter 1: Introduction

It is estimated that by 2030, 366 million people in the world will have diabetes mellitus (Brem, 2006). Over 1.5 million Canadians have diabetes, and 90% have type 2 diabetes (Center for Disease Control and Prevention, 1998; O'Brien, Patrick, & Caro, 2003; Public Health Agency of Canada, 2003). The prevalence of type 2 diabetes in Canada's aboriginal population (First Nations, Metis and Inuit) is three times that of the national average (Health Canada, 2001). Approximately 15% of all people with diabetes (PWD) will develop lower limb ulceration sometime in their lifetime (Orsted, Searles, Trowell, Chapera, Miller, & Rahman, 2006; Singh, Armstrong, & Lipsky, 2005; Stockl, Vanderplas, Tafesse, & Chang, 2004 Sep). Diabetic foot complications including ulceration and amputation, increase seven fold in the elderly population of PWD ages 75 and over (Campbell, Graham, Kidd, Molloy, O'Rourke, & Colagiuri, 2000). The economic, medical and social consequences of diabetic lower limb ulceration are staggering with lower limb ulceration preceding 80-85% of all lower limb amputations in PWD (Centers for Disease Control and Prevention, 2003b; Rathur & Boulton, 2005). However, the risk of diabetes-related foot complications can be reduced by an estimated 49 to 85% by proper preventative measures, patient education and self foot-care (Apelqvist, Bakker, van Houtum, Nabuurs-Franssen, & Schaper, 2000; Centers for Disease Control and Prevention, 2003a).

Other lower limb complications are life-altering for PWD and may include loss of self-esteem, depression, loss of income, disruption of support networks and/or difficulties with activities of daily life. While this suggests an acute problem, effective chronic disease management of PWD underpins prevention of lower leg ulceration and

amputation. Indeed, recognition of risk factors, preventative foot-care and regular foot examinations are consistently identified in related literature as essential in preventing foot ulcers in PWD (Jeffcoate, Price, Harding, & International Working Group on Wound Healing & Treatments for People with Diabetic Foot Ulcers, 2004; Lavery, Armstrong, Vela, Quebedeaux, & Fleischli, 1998; Mensing, Boucher, Cypress, Weinger, Mulcahy, & Barta,, 2006; Orsted et. al., 2006; Registered Nurses Association of Ontario [RNAO], 2004; Registered Nurses Association of Ontario [RNAO], 2005; Schaper, Apelqvist, & Bakker, 2003).

Significance of the Problem

The 2005 Canadian nursing best practice guidelines for assessment and management of foot ulcers for PWD support client empowerment and education as their first practice recommendation (RNAO, 2005). Health promotion, client empowerment and facilitation of effective self care through education are identified as essential elements of nursing (RNAO, 2005). However, acute symptoms and concerns often continue to crowd out the less urgent need to bring chronic illness under optimal management. In many instances, evidence-based guidelines for diabetes care are not consistently being met by health care practitioners or by people living with diabetes (Bodenheimer, Wagner, & Grumbach, 2002).

Increasingly, evidence suggests that a greater emphasis on supporting self care behaviors is essential to effective disease management. Closing the gap between knowledge and practice in PWD requires that changes in behaviors and maintenance of behavior changes occur following diabetes self-management interventions (Glasgow, Funnell, Bonomi, Davis, Beckham, & Wagner, 2002; Glasgow, Toobert, Hampson, &

Strycker, 2002 Oct -Nov). Bolstering confidence in the ability to effectively implement self care strategies is the next important step in promoting active personal management of diabetes (Ellison & Rayman, 1998; Paterson, Thorne, & Dewis, 1998). Research affirms that PWD who display a higher degree of self-efficacy or confidence in self care, utilize better care practices (Glasgow, Toobert, Riddle, Donnelly, Michell, & Calder, 1989; Hurley & Shea, 1992). However strategies relating to enhancement of knowledge, practice and self-efficacy are not consistently reported or discussed.

The results of studies have shown educational interventions improve self foot-care knowledge, behaviors and self-efficacy (Corbett, 2003; Hamalainen, Ronnemaa, Toikka, & Liukkonen, 1998; Litzelman, Slemenda, Langefeld, Hays, Welch, Bild, et. al., 1993). Comparisons of study findings are difficult due to lack of consistency in instruments used for measurement. As well, most researchers report only total scores on measures of self-foot-care knowledge, behaviors and self-efficacy rather than providing a breakdown of individual item scores. No research was found in which PWD with and without ulceration are compared on self-foot-care knowledge, behaviors and self-efficacy. Are there differences between these two groups? Might PWD with lower limb ulcerations have different self care needs than those people without? Clarifying the target population and determining self-management education needs allows health care providers to focus resources and maximize health benefits (Mensing et. al., 2006). A clearer understanding of self-management knowledge, practice and self-efficacy of PWD with and without lower limb ulceration may assist in the development of more effective population specific, diabetic educational interventions in the future.

Purpose of Study

The purpose of this study was to describe and compare foot-care knowledge, foot-care practices and degree of self-efficacy in performing foot-care in two populations of individuals with type 2 diabetes; one with lower limb ulceration and one without. This information may assist in future development of self-management educational supports for PWD and lower limb ulceration.

Research Questions

Three research questions were addressed: 1) Do PWD with and without lower limb ulceration differ on their self foot-care knowledge? 2) Do PWD with and without lower limb ulceration differ on self foot-care practice? 3) Do PWD with and without lower limb ulceration differ on self-efficacy in performing self foot-care?

The following definitions by Corbett (2003) provide clarity regarding the variables described. Self foot-care knowledge is defined as the evidenced-based knowledge and underlying theory behind appropriate foot self care. Self foot-care practices/behaviors are defined as those strategies supported by clinical practice guidelines that the individual with diabetes actually does as part of their foot-care self-management plan. Self-efficacy when performing foot-care relates to the individuals' confidence in caring for their own feet. That is, not what they do, but how confident they are in doing so. Lower limb ulceration refers to any skin breakdown of the lower limb including minor eruptions on the toes, heel or foot.

Chapter 2: Review of the Literature

An extensive literature search was conducted of CINAHL, MEDLINE, Cochrane Library, Health Source, Scopus, EMB Reviews, Proquest Dissertations and Theses-Full Text and Google electronic databases from the past ten years to reflect most current trends, best practice, evidence based research, and discussion. Original studies from earlier years that were identified through the literature review as important and relevant were also retrieved. Key words included: diabetes, education, self-management, self care, foot-care, self-efficacy, self-confidence, lower limb/lower leg/lower extremity ulceration, foot ulcer, foot risk, complication prevention and amputation reduction.

The results of the literature review are presented following a brief description of the theoretical framework used to guide the study, and background information about current self-management advocated for people with type 2 diabetes and lower limb complications. The results of previous studies on the self-management foot knowledge, self-management practice and self-management self-efficacy of people with diabetes are then described.

Theoretical Framework

A review of research and self-management frameworks supports the notion that self-management is essential to effective treatment of chronic disease conditions such as diabetes (Bodenheimer et. al., 2002; Epping-Jordan, Pruitt, Bengoa, & Wagner, 2004; Fisher, Brownson, O'Toole, Shetty, Anwuri, & Glasgow, 2005; Glasgow et. al., 2002; Holman & Lorig, 2004; Lorig, Ritter, Stewart, Sobel, Brown, Bandura, et. al., 2001; Lorig, Sobel, Stewart, Brown, Bandura, Ritter, et. al., 1999; Whittemore, 2000). Perceived self-efficacy is confidence that one can accomplish a certain goal.

Understanding the impact of personal perception of self-efficacy as it applies to health behavior is a common thread through research pertaining to effective strategies for health education interventions (Bodenheimer et. al., 2002; Lorig et. al., 1999; Marks, Allegrante, & Lorig, 2005a; Marks, Allegrante, & Lorig, 2005b; McDowell, Courtney, Edwards, & Shortridge Baggett, 2005).

According to Bandura's Social Cognitive Theory (1989), successful self-management is dependent on supporting a person's base of knowledge and skill, while also ensuring a sense of ongoing self-confidence in being able to put this knowledge and skill into practice. Four principal sources of efficacy information are used to enhance efficacy. These include: direct mastery experiences; observing success through perseverance of people similar to oneself; social persuasion that possesses the capabilities to succeed; and judgments of bodily states and various forms of somatic information.

Self Care/Self Management

PWD are responsible for daily management of their disease, for emotional adjustments, behavior changes and accurate reporting of disease trends and tempos (Holman & Lorig, 2004). They must also apply therapies within guidelines supplied by health care providers and seek professional help when needed to prevent health complications and death (Redman, 2005). In addition, they must also wade through the plethora of information available over the internet and decipher what is factual/research based and what is not. While people with chronic diseases such as diabetes are responsible for their own self care, there is a shared responsibility between health care

providers and clients in assuring competency to perform self-management strategies (Redman, 2005)

Over the past 20 years, there has been a growing interest in fostering the means by which people affected by chronic disease(s) can effectively participate in managing their own illnesses. While no real estimates are available, nurses provide much of the preparation for self-management of people with chronic diseases (Redman, 2005). Much of the earliest work to help people learn disease self-management skills was done in arthritis disease management (Lorig, Chastain, Ung, Shor, & Holman, 1989; Lorig, Feigenbaum, Regan, Ung, & Holman, 1986; Lorig & Holman, 1993). A review of research and self-management frameworks supports the notion that self-management is essential to effective treatment of chronic disease conditions (Bodenheimer et. al., 2002; Epping-Jordan, et. al., 2004; Fisher et. al., 2005; Glasgow et. al., 2002; Holman & Lorig, 2004; Lorig et. al., 2001; Lorig et. al., 1999; Whittemore, 2000).

Successful self-management strategies may also reduce preventable mortality and morbidity while improving the quality of life of individuals and families (Redman, 2005). However, more research is needed. In Canada, the evolution of self care is a central concept within health policy in which Canadians have "both a right and an obligation to take charge of their personal health and to take part in decisions made on their behalf" (National Forum on Health, 1997).

Key Components of Self-Management for Type 2 Diabetes

Type 2 diabetes results from a combination of insufficient insulin production and/or resistance of the cells of the body to the actions of insulin (Clinical Practice Guidelines Expert Committee, 2003). While this definition is technically correct, it does

not speak to the overwhelming demands that the disease makes on PWD. In fact, diabetes mellitus has been described as one the most behaviorally and psychologically demanding of all the chronic diseases (Cox & Gonder-Frederick, 1992). The major components of diabetes self-management require challenging lifestyle changes even for the most disciplined and well-intentioned person. Self care strategies focused on the achievement of optimal glycemic control are needed to help prevent damage to the body's small and larger nerves and blood vessels. Dietary modifications, management of prescribed medication, exercise, foot-care and healthy lifestyle changes such as smoking cessation are all important self care strategies for PWD. Over time however, failure to maintain optimal glycemic control can affect functioning of many of the body's organs, including the skin.

It is generally accepted that at least reasonable level of disease related knowledge is essential to PWD however, studies have shown that knowledge is only one of several variables influencing metabolic control (Coates & Boore, 1996; Whittemore, 2000) and self-management performance (Persell, Keating, Landrum, Landon, Ayanian, Borbas, et. al., 2004). A review of randomized control trials specific to self-management interventions for PWD shows that there has been a shift over the past two decades from a focus on didactic education to the current focus on education that encourages and supports patient empowerment and participation (Coates & Boore, 1996; Glasgow et. al., 2002; Norris, Engelgau, & Narayan, 2001). Currently, both the Canadian Diabetes Association and the American Diabetes Association acknowledge that successful diabetes care depends on the daily commitment of the person with diabetes mellitus to

self-management through the balance of lifestyle and medication (Clinical Practice Guidelines Expert Committee, 2003; Mensing et. al., 2006).

Potential Lower Limb Complications of Type 2 Diabetes

Approximately 15% of all PWD develop lower limb ulceration sometime in their life (Orsted et. al., 2006; Singh et. al., 2005; Stockl et. al., 2004). Risk factors for developing lower limb complications in PWD include peripheral neuropathy (most prominent), peripheral vascular disease, previous lower limb ulcerations, foot deformity (American Diabetes Association, 2003; Armstrong & Lavery, 1998; Boulton, Kirsner, & Vileikyte, 2004; RNAO, 2005; Singh et. al., 2005) and infection (Orsted et. al., 2006). Poor glycemic control, lack of foot-care education, low socio-economic status, other diabetic complications (such as obesity and edema) and poor foot-care resulting from other psychological and physical disabilities also contribute to an increased risk of developing lower limb complications (Armstrong & Lavery, 1998; Boulton et. al., 2004; Singh et. al., 2005).

Diabetes is the leading cause of non-traumatic, lower limb amputations in industrialized countries (Orsted et. al., 2006). Up to fifty-one percent of PWD, who have a lower extremity amputation, will require a second amputation within five years (Campbell et. al., 2000; Reiber, Boyko, & Smith, 1995). The five year survival rate for PWD after amputation is 27-50% (Campbell et. al., 2000; Stockl et. al., 2004). Eighty-five percent of lower extremity amputations are preceded by foot ulcers (Boulton et. al., 2004; Orsted et. al., 2006; Reiber, et. al., 1995) which are defined as any skin breakdown on the foot (Centers for Disease Control and Prevention, 2003a) including even minor eruptions on the toes, heel and the dorsal and plantar foot (Brem, Sheehan,

Rosenberg, Schneider & Boulton, 2006). Foot ulceration in PWD is widely recognized as a significant end-stage complication of diabetes PWD (Orsted et. al., 2006) and PWD who have had a foot ulcer, are at life-long risk of further ulceration (Campbell et. al., 2000).

Self Foot-Care Knowledge

Self foot-care knowledge is identified as essential for PWD in evidence based clinic practice guidelines (CPGs) (Apelqvist et. al., 2000; Center for Disease Control and Prevention, 1998; Clinical Practice Guidelines Expert Committee, 2003; Kalla, 2005; Orsted et. al., 2006; RNAO, 2004; RNAO, 2005). Three studies were found in which self foot-care knowledge of PWD was measured before and after an educational intervention, using a variety of instruments.

Hamalainen (et. al.,1998) evaluated foot care knowledge and self care habits of 733 participants, aged 10 to 80 years of age, in a randomized study evaluating the effectiveness of the activities of a podiatrist in the out patient foot-care of PWD (type 1 and type 2). Participants were selected from the National Diabetes Register of Finland. Participants with severe foot problems or obvious foot-care needs were excluded. Knowledge scores were compared between the control group and the intervention group (individual counseling and primary prevention measures) at baseline, at one year and at seven years post-intervention. Self foot-care knowledge was measured using an un-named 19 item questionnaire. Of these 19 questions relating to different foot-care topics, seven pertained to self foot-care habits. These seven questions consisted of questions about hygiene, use of emollient cream, foot inspection and foot exercises (Ronnemaa, Hamalainen, Toikka, & Liukkonen, 1997). The researchers reported that subjects in the

podiatrist intervention group had greater improvements in total scores on knowledge of diabetes foot-care ($p = 0.004$) and self care ($p<0.001$) compared with the control subjects. Group differences on individual items or domains of the questionnaire were not mentioned. Neither study validity, reliability nor rigor of the tests used was reported, nor was there a clear reference for finding more information on tool used. The results of this research showed significant gains in knowledge and foot self care scores are maintained up to seven years. It is of interest to note that this tool does identify hygiene, emollient or moisturizer use, foot inspection and foot exercise as important areas of knowledge and self foot-care in PWD.

Kruger & Guthrie (1992) investigated the effectiveness of a hands-on foot-care education session in addition to a lecture component compared to a lecture only format (no "hands-on"). The sample included 50 people who had diabetes for a duration of more than 5 years and without evidence of undefined "frank pathology" (Kruger & Guthrie, 1992). Researchers used an un-named 12-item test of foot-care knowledge, which was developed by the Michigan Diabetes Treatment Center, and adapted with permission for this particular study. Data on foot-care knowledge and skills, condition of feet and HgA1c levels was collected at baseline and at 6 months post intervention. Findings of this American study did not show a significant increase in knowledge between groups as a result of the participatory, hands-on teaching/learning approach, with minimal changes in reported self-foot-care practices. The reliability quotient for the testing tool was reported at $r=0.68$, but little information was given on contents of the test nor was the original tool directly referenced. Limitations of the study included a

small sample size and considerable numbers of missing cases in the post intervention assessment (Kruger & Guthrie, 1992).

Lastly, Corbett (2003) conducted a randomized pilot study of improving foot-care in home health patients with diabetes. Foot-care knowledge, practice and self-efficacy were examined in this prospective, single-center, convenience sample of 40 home care clients (without lower limb ulceration). Participants were randomized into an educational intervention group and a control group. The Foot-Care Knowledge Questionnaire was utilized to test the effectiveness of an individualized educational intervention in improving foot-care knowledge of PWD (self care practice and self-efficacy were also separately measured). All participants were initially assessed, then again at six weeks to control for foot-care interventions provided during routine home care services. After the six week assessment, the intervention group received foot-care education that consisted of standard topics that were individualized according to participant's risk factors, foot-care knowledge, reported self care behaviors and self-efficacy. Foot-care knowledge was then reassessed in all participants, twelve weeks after study entry. Content validity of the knowledge tool was established during instrument development and the tool was well referenced to its original source (Barth et. al., 1991). Baseline foot-care knowledge scores over the 6 week pre-intervention period were given with ranges from 1-7 on a scale (mean= 4.75, SD=1.56). Participants in the intervention group showed a significant, overall improvement in foot-care knowledge ($p = .007$). An individual item analysis showed the lowest level of knowledge pertained to the type of shoes that should be worn and when to consult a physician regarding foot problems (Corbett, 2003). This American study was of particular interest because of the

comprehensive baseline assessment of knowledge, which was well defined in the study and because PWD with lower limb ulceration and/or amputation were excluded.

Two of the three studies reviewed showed significant improvement in self foot-care knowledge following an educational intervention, while results of the third study were inconclusive. One study showed maintenance in foot-care knowledge following an educational intervention over a period of three months (Corbett, 2003) while the other showed maintenance in knowledge gains for up to seven years (Hamalainen et. al., 1998). Only one study provided a description of the item analysis of their measure of self foot-care knowledge. None of the studies compared the self foot-care knowledge of PWD without lower limb ulceration with PWD with lower limb ulceration. The incidence of diabetes, combined with the high personal and monetary cost of lower limb complications such as ulceration and amputation, makes initial assessment of self foot-care knowledge, along with a comprehensive demographic and clinical assessment of PWD important in planning strategies to support self care.

Self Foot-Care Practices

Self foot-care practices refer to what PWD do to care for their feet. These practices are based on evidence based CPG and fall within the following commonly reported categories: self-examination of the foot (including toenails, soles, between toes, and abnormal conditions such as blisters/ulcers), washing feet (do not soak, water temperature), moisturizing skin of feet, and choice of footwear (appropriate, wear all the time, examine inside of shoes) (Apelqvist et. al., 2000; Clinical Practice Guidelines Expert Committee, 2003; Corbett, 2003; Kalla, 2005; Kruger & Guthrie, 1992; Litzelman et. al., 1993; Rettig, et. al., 1986). It was noted that measurement of

knowledge behavior (practice) is prone to bias because of the subjective outcomes measured (Valk, Kriegsman & Assendelft, 2005).

Litzelman (et. al., 1993) evaluated the effect of patient, health care provider and systems interventions on the prevalence of risk factors for lower limb amputation of 395 Americans with non-insulin dependent diabetes. A multi-faceted 12 month intervention was used in which participants received foot-care education and entered into a behavioral contract for desired self foot-care. This was reinforced through telephone and postcard reminders. Health care providers were given practice guidelines and informational flow sheets on foot related risk factors for amputation in PWD. Additionally, the folders of intervention participants were flagged with special identifiers that prompted health care providers to address foot-care with participants at each contact. As part of this study, researchers utilized an interview style to question participants regarding their regular foot-care routine and included having PWD demonstrate their self foot-care behaviors or practices. In addition, a 5-point scale with 12 questions about self foot-care was also used to validate and measure practice. These questions were referenced to the original source and included all of the components related to CPG categories previously mentioned. Validity of the tool was not reported. Study results concluded that the intervention positively affected participant self foot-care behavior; positively affected foot-care by health care providers; and reduced the prevalence of lower extremity complications in PWD. Initial participant assessment is included and participants with lower limb ulcerations were included in the sample, however, differences in self care practices were not distinguished between PWD with and without ulceration. Participant behaviors most commonly practiced post-

intervention included washing feet (not soaking), drying in between toes, inspecting feet, inspecting inside of shoes and filing calluses.

Bell, Arcury, Snively, Smith, Stafford et.al., (2005) utilized the revised Summary of Diabetes Self Care Activities Measure (SDSCA) questionnaire (Toobert, Hampson, & Glasgow, 2000) in this non-interventional study, to assess the level of self foot-care in a rural, multiethnic population of 701 older adults and to identify factors associated with self foot-care. The SDSCA measurement tool was found to show good internal and test-retest reliability when generalized to various patient populations with diabetes (Bell et. al., 2005; Toobert et. al., 2000). Self foot-care behaviors were measured over a 7 day period, with data collected over a two year period. Appropriate self-management behaviors performed with the highest frequency were washing the feet (75.6%) and not soaking the feet (79.2%). Conversely, 23% of participants inappropriately did not check their feet at all and 54% did not inspect their shoes before wearing them (Bell et. al., 2005). Interestingly, four factors were independently associated with self foot-care scores; women were more likely than men to engage in self foot-care activities, participants who were shown how to care for their feet had higher foot-care summary scores, participants who were checked for peripheral neuropathy by a health professional had higher foot-care index scores compared to those participants who had not, and participant who did not receive support caring for their feet (not dependent on either formal or informal foot-care support) had better foot-care practices overall. This study provided a good overall description of self foot-care behaviors and factors influencing self foot-care. However, while data was collected from participants regarding lower limb amputation, no data is evident regarding presence of lower limb ulceration in the sample.

Three studies previously outlined with regard to self foot-care knowledge also examine self foot-care practice of participants following an educational intervention (Corbett, 2003; Hamalainen et. al., 1998; Kruger & Guthrie, 1992). Hamalainen et. al.'s study (1998) measured the self foot-care score of participants based on seven questions concerning personal foot-care practices. The total score (1 to 12 points) was derived from questions about hygiene, use of emollient cream, foot inspection and exercising the feet. Analysis of results indicated no significant difference between the intervention and the control groups at baseline, though women in both groups had significantly higher scores than men. Self foot-care scores were significantly higher post intervention, with the greatest change during the first year. Overall, women's scores were higher and improved significantly more than men's over the duration of the seven year study, which confirms reports that women are usually more motivated to take care of their health than men (Hamalainen et. al., 1998; Reddy, Fleming & Adesso, 1992). There was no differentiation made between participants with and without lower limb ulceration.

Kruger and Guthrie's (1992) reported self foot-care practices of participants six months after the educational intervention. In addition to the 12-item test of foot-care knowledge, developed by the Michigan Diabetes Treatment Center, participants completed a Daily Foot Check Sheet which included 17 items related to the condition of their feet and their foot-care practices. Significant improvements were noted in the lecture and hands-on group compared to the lecture only group, with respect to care of toenails and inspecting and washing feet daily. As with the assessment of self foot-care knowledge, a significant number of participants did not complete the study. The study concludes that a hands-on educational intervention may temporarily improve self foot-

care practices, with overall findings being inconclusive. There was no differentiation made between participants with and without lower limb ulceration.

Corbett's (2003) study, utilized the Foot-care Practices Questionnaire, to assess participants' current self foot-care practices. Again, a multiple-response format with four choices for each of the seven questions was used, with correct answers scored as one point (possible scores from 0-7). Respondents were asked to answer questions according to which category matched their self foot-care practices more closely. It was reported that content validity was established during instrument development (Barth, Campbell, Allen, Jupp, & Chisholm, 1991). Participants in the intervention group showed a significant, overall improvement in reported self care behaviors ($p = .003$). The researcher indicated that only 19% of participants reported wearing protective shoes, with 47% conducting daily foot inspections and 89% reporting that they washed their feet in warm water and applied moisturizer. This American study was of interest because of the comprehensive baseline assessment of not only knowledge, but also of self foot-care practices of PWD without lower limb ulceration or amputation.

There is evidence in the literature that education positively impacts self foot-care behavior. Two studies reported gender differences in self foot-care practice (Bell et. al., 2005; Hamalainen et. al., 1998) which may be related to differences in motivation (Hamalainen et. al., 2005). While themes exist with respect to important self foot-care practices (foot hygiene, foot inspection, nail care, footwear inspection and callous management) a variety of instruments have been used to measure self foot-care practice, making it difficult to compare the results of studies. In addition, no study was found that compared the self foot-care practices of PWD without lower limb ulceration with PWD

with lower limb ulceration. As with self foot-care knowledge, individual item analyses of measures of self foot-care practice is limited.

While subjective measurements of self foot-care practices are prone to bias, a consistent thread throughout the literature is that self foot-care knowledge and practice are linked. Better knowledge results in better self care practices (Bell et. al., 2005; Kruger & Guthrie, 1992; Litzelman et. al., 1993; Mazzuca et. al., 1986). In addition, activities that require patients to become more actively engaged in their foot-care appear to have the outcome of better self foot-care practices (Bell et. al., 2005).

Self Foot-Care Efficacy

Self-efficacy in foot-care refers to the degree of confidence PWD have regarding performance of foot-care on themselves. While research into self foot-care knowledge and practice is somewhat limited, certainly, there is more emphasis on these particular aspects of foot-care than on self-efficacy or confidence in performing foot-care. Two studies in which self-efficacy in foot-care was investigated were identified in this literature review.

Sloan (1997) developed and tested the Foot-Care Confidence Scale (FCCS) on a sample of 122 older adults who had diabetes for more than 5 years (average was 15 years). The goals of this non-interventional study were threefold; to examine the psychometric properties of the FCCS, determine the level of foot-care self-efficacy of PWD and to compare the FCCS scores among PWD according to sources of foot-care education. Participants were asked to rate their self foot-care confidence on each of the 12 items using a Likert-type scale ("strongly confident" to "strongly not confident"). Content validity was established and the instrument was reviewed based on feedback

from pilot testing, CVI judges and additional review of associated literature. A Cronbach's alpha of 0.92 was reported which indicates that the tool is internally consistent with all 12 items being needed to measure self-confidence (Sloan, 2002). The range of means on the FCCS indicates that participants were most confident with their ability to call their doctor about problems with their feet, and least confident in their ability to trim their own toenails (straight across). The source of foot-care education was not associated with FCSS scores. The FCSS tool was found to be a practical instrument for use in many settings, to define short and mid-term outcomes of patient foot-care education programs for PWD, especially where time constraints were an issue. Although participants with and without ulcers were included in development of the tool, differences in self foot-care efficacy between ulcer and no ulcer groups were not reported. This study focused on tool development rather than identification of differences in study groups, but did provide an assessment of foot-care self-efficacy in PWD.

Finally, Corbett (2003) measured the foot-care self-efficacy of home health patients with diabetes. This is in addition to the assessment of knowledge and self care practices as discussed in previous sections. The Foot-Care Self-Efficacy Questionnaire was developed by Corbett (2003) for this study. Participants rated confidence (levels 1-6; strongly agree to strongly disagree) in 7 aspects of foot-care that corresponded to the 7 domains measured by the knowledge and self care practice tools utilized in this study. Preliminary content validity was established through a panel of expert diabetes clinicians. The instrument was pilot tested for readability and clarity by several PWD not involved in the study. A Cronbach's alpha of 0.69-0.73 is reported, indicating an

acceptable level of reliability for a newly established tool. Participants in the intervention group showed a significant, overall improvement in self-efficacy ($p = .014$). Study results indicate that participants' had the most baseline confidence in their ability to talk to their doctors about problems with their feet (94% agreed or strongly agreed) and in being able to wash their feet properly (86% agreed or strongly agreed) (Corbett, 2003). Participants had the least confidence in their ability to choose appropriate footwear (55% agreed or strongly agreed, that they could consistently wear appropriate footwear) or to wear shoes and socks at all times (58% agreed or strongly agreed that they were confident in their ability to wear socks and shoes at all times) (Corbett, 2003). Again, Corbett excluded PWD with lower limb ulceration and/or amputation from this study.

While self foot-care knowledge and practice are frequently linked within the literature (Kruger et. al., 1992; Hamalainen, et. al., 1998), the degree of self-efficacy or confidence related to knowledge and practice is often omitted leaving a gap in nursing knowledge. As with self foot-care knowledge and practice, there was no research found comparing self-efficacy of foot-care in PWD with and without lower limb ulceration.

Summary

There is evidence to suggest educational interventions result in an increase in measures of self foot-care knowledge, practice and self-efficacy among PWD. Further, there is evidence that gains in knowledge, practice and self-efficacy following educational interventions are maintained over varying spans of time, particularly in the short term. No previous studies have compared the maintenance of foot-care self-knowledge, practice and self-efficacy between PWD with and without lower limb ulcers.

Only Corbett (2003) offered a description of item analyses for her measures of self foot-are knowledge, practice and self-efficacy (Corbett, 2003). Comparisons of PWD with and without lower limb ulcers on total scores and on the individual items of measures of self foot-care knowledge, practice and self-efficacy would be expected to more precisely identify areas we need to target educational strategies to reinforce learning among PWD.

Chapter 3: Method

In this chapter the author provides a description of the study design, the sample and recruitment criteria together with the setting. Next the instruments and data collection procedures are presented. Following a discussion of the data preparation and analyses procedures, the ethical considerations are highlighted.

Research Design

An exploratory, comparative, descriptive design was used to address the three research questions: 1) Do PWD with and without lower limb ulceration differ on their self foot-care knowledge? 2) Do PWD with and without lower limb ulceration differ on self foot-care practice? 3) Do PWD with and without lower limb ulceration differ on self-efficacy in performing self foot-care?

Sample, Sample Selection and Setting

A sample of 32 people with diabetes was recruited into the study; 16 PWD without lower limb ulceration and 16 PWD with lower limb ulceration. The study inclusion criteria were: diagnosis of type 2 diabetes, mentally and physically able to participate in the study, able to read/understand English, 18 years of age or older and currently performing own daily foot-care (nail care may be excluded). Inclusion criteria were consistent with Corbett's (2003) sample selection for PWD without lower limb ulceration. In the group of PWD with lower limb ulceration, participants were required to have had an existing lower limb ulceration of at least 3 months duration (indicating chronic wound status) and to have lower limb ulceration on one extremity only (so that they could answer foot-care questionnaires related to their unaffected limb). The sample was obtained using a convenience sampling technique over a 3 month period.

Consecutive, eligible clients attending the Community Care Clinic (CCC) at the WestView Health Centre (WVHC), Stony Plain, Alberta were invited to participate in the study. A sample size of 16 for each group was chosen based on the exploratory nature of this study and the pragmatic consideration of a reasonable timeline for a student researcher's program completion.

WVHC was selected as the setting based on two considerations. First, this facility conducts specialized lower leg assessments and plans complex wound management routinely using state of the art assessment equipment (photoplethsmography, mono-filament testing and vascular doppler). Second, this facility currently does not offer formalized educational or behavior support systems with relation to foot-care or self-management strategies. Thirdly, the incidence of PWD is higher among those clients attending CCC because of the lower extremity assessment and chronic wound focus of the clinic. On average approximately 20-25% of people who visit CCC have diabetes with more than 85% of these having wounds on their lower extremities. This allowed a total of 32 participants (16 in each group) to be recruited over a 10 week period.

Agency access was obtained from the Community Care Services (CCS) Manager responsible for CCC and from the WVHC Site Director. Further, physical space for data collection was arranged within the CCC and a locked cabinet was used for data storage.

The CCC at WVHC served as the setting for this study. Following ethical approval, four registered nurses (RNs) specializing in lower limb assessment and complex wound management were enlisted to become part of the research team and assist the researcher in collection of data. They were oriented by the researcher to study

purpose, participant inclusion criteria and data collection instruments. Each of these RNs, including the researcher, have extensive experience in lower limb assessment of PWD, follow evidence based, best practice guidelines and have been similarly educated/oriented to complex wound assessment and management. Each was qualified to perform the necessary assessments (monofilament testing, toe pressures and ankle brachial indices). To evaluate consistency in data collection, inter-rater reliability was measured by having each of the four RN's assisting in data collection, including the researcher, perform each of the assessments (monofilament testing, toe pressures and ankle brachial indices) in pairs (no less than 10 times per test) with consensus having been reached ≥95% of the times. In instances of non-consensus, the test was repeated again, until consensus was achieved. A comprehensive health history and lower leg and wound assessment is routinely completed as part of each client's admission to CCC. This information was transcribed from the client's chart utilizing the Health History and Lower Limb Assessment Form developed for this study.

Data Collection Instruments

Six instruments were used in this research study. Permission was obtained from the appropriate source for use of five of these instruments. A sixth instrument was developed by the principal researcher. Three instruments were used which relate directly to the research question (Appendices A, B & C). Three additional instruments were used to provide assessment of health history and lower limb ulceration risk and wound classification (Appendices D, E & F). A description of each of these tools follows.

The Foot-Care Knowledge Questionnaire was used to assess knowledge of appropriate foot self care (Barth et. al., 1991). The Foot-Care Knowledge Questionnaire

is comprised of seven multiple choice items, each with four or five response options (Appendix A). The items address foot-care knowledge regarding what is observed, what is done if the skin is dry or rough, how the feet are washed and dried, what shoes are worn, when socks and shoes are worn and what is done if a blister or sore develops. This questionnaire evaluates what PWD what they should do with regards to self foot-care.

The Foot-Care Practices Questionnaire assesses participants' current self foot-care practices (Appendix B). The Foot-Care Practices Questionnaire is comprised of seven multiple choice items each with four or five responses (Reiber, Pecoraro, & Koepsell, 1992). The questions address the same seven areas included in the Foot-Care Knowledge Questionnaire. However participants are asked to indicate what they do in relation to each area. For example, "I should look at my feet carefully: with response options addressing how often participants think this should be done.

The Foot-Care Knowledge Questionnaire and *Foot-Care Practice Questionnaire* were scored by assigning one point for each correct answer with a possible range of scores from zero to seven for each instrument. Content validity was established during each instrument development (Barth et. al., 1991). Respondent scores on knowledge and self care increased after intensive foot-care education in prior research, suggesting construct validity (Ward, Metz, Oddone, & Edelman, 1999). Internal consistency reliability (KR020) was low (r=0.27-0.47 over the 3 measurement times), suggesting the seven knowledge and self care activities are from independent domains (Corbett, 2003). Therefore, knowledge or self care in one aspect of diabetes foot-care as operationalized by a single question in these instruments was not highly correlated with other aspects of foot-care measured (Corbett, 2003).

The Foot-Care Self-Efficacy Questionnaire was used to ask participants to rate their confidence in seven aspects of foot-care that correspond to the seven domains measured by the knowledge and self care questionnaires (Corbett, 2003). Respondents ranked their confidence in performing each self care activity in one of six levels ranging from strongly agree to strongly disagree, with a possible range of scores from zero to five for this instrument (Appendix C). Preliminary content validity was established by a panel of expert diabetes clinicians, and the instrument was pilot tested for clarity and readability by persons with diabetes during development (Corbett, 2003). Internal consistency reliability is reported (Cronbach's alpha) from 0.69-0.73 (Corbett, 2003). The self-efficacy tool items are likely more highly correlated than the knowledge or self care items because the self-efficacy tool measures attitudes versus actual knowledge or self care behaviors (Corbett, 2003).

The *Health History and Lower Limb Assessment Form* was developed by the researcher for the purposes of this study to collect specific information from medical records and health histories and to record lower limb assessment results (Appendix D). This tool was developed based on RNAO practice recommendations (RNAO, 2005; RNAO, 2004; Orsted, et. al., 2006) and on the experience of the researcher as an expert in lower limb and wound assessment. Basic participant demographics, health history, vision, lower leg (ankle brachial pressure index and toe systolic pressure) and foot assessment (pedal pulses, edema, neuropathy, protective sensation, skin, structural deformities, toenails, footwear and pressure gradient stocking use), including assessment of any ulcerations according to RNAO Recommendation 3.1 (RNAO, 2005), was

completed. There is no scoring format for the items in this instrument because all measured variables were discrete.

The University of Texas Foot Classification System (Appendix E) was used to classify risk factors for ulceration or amputation based on information collected in Health History and Lower Limb Assessment Form. This is a complex risk assessment tool that is a validated, logical instrument (Armstrong, 1996; Armstrong, Lavery, & Harkless, 1998b). PWD were stratified into ulceration or amputation risk groups based on findings of the comprehensive lower limb assessment. For the purposes of classification, peripheral neuropathy was evaluated by using a 10-gram monofilament according to nursing best practice guidelines recommendations (RNAO, 2005). Peripheral vascular supply was assessed through measurement of ankle brachial pressure indices (ABPI) and toe systolic pressure using photoplethsmography (PPG) (RNAO, 2005).

The University of Texas Health Science Center San Antonio Diabetic Wound Classification System (Armstrong, Lavery, & Harkless, 1998a) was used to classify and grade participants' lower limb ulceration (Appendix F). This wound classification system includes assessment of wound depth, infection, and ischemia. The instrument has been validated to show deterioration in wound outcomes (i.e. amputation) with increasing grade and stage of wounds (Armstrong & Lavery, 1998). The latter two classification systems are utilized in the Canadian RNAO Nursing Practice Guidelines, and provide a consistent method of comparison of participants. The researcher was available by telephone to staff collecting data, to answer any questions regarding data collection.

Data Collection Methods

A research team of RNs was enlisted to assist the researcher in subject recruitment for this research project. Individuals were screened during the intake process of new clients presenting to CCC or during client's regularly scheduled visits at CCC. An information letter (Appendix G) regarding the study was given to PWD meeting inclusion criteria. This information letter included the purpose of the study, what the study involves, and how the information will be used. Issues of privacy and consent were addressed, and individual names and personal information were passed onto the researcher if the individual was in agreement and gave written consent (Appendix H).

The researcher consulted with the research team on a Monday through Friday basis to identify any individuals that met inclusion criteria. If an individual met inclusion criteria and gave verbal and signed consent to participate in the study, their personal contact information was made available to the researcher. The researcher contacted the prospective study participant either by telephone, or in person (at the individual's next CCC appointment), within seven days to confirm their interest in participating in the study, and to answer any questions that they may have had regarding the study. At the participants' next CCC appointment, informed consent was obtained (Appendix I), the Health History and Lower Limb Assessment Form was completed and surveys were given by the researcher.

Following the assessment and collection of survey data, a risk category was assigned according to the University of Texas Foot Classification System. For those participants with lower limb ulceration, the University of Texas Health Science Center

San Antonio Diabetic Wound Classification System was used to categorize ulcer status.

Data Preparation and Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS version 15.0 for Windows). The researcher created the template and entered all data using nominal or ordinal scales. Data was manually rechecked until 100% accuracy was achieved in random checks for entry errors to ensure accuracy of the data set prior to analysis. Data sensibility was observed. Participants were assigned to one of two groups: PWD with lower limb ulceration (Ulcer Group) or PWD without lower limb ulceration (No Ulcer Group). Non-parametric, descriptive statistics were used to summarize the demographic and clinical characteristics of the sample and to summarize participant scores on the outcome variables by groups. Data were placed in tables. Chi-square was used to describe group comparisons on nominal data. The independent two-tailed t-test was used to make group comparisons on the total scores on measures of self foot-care knowledge, practice and self-efficacy. The alpha level was set at .05.

Ethical Considerations

There were no identified risks or benefits for participants; however, central protection for research participants was to guarantee that someone other than the investigator would assess the risks of the proposed research. This research proposal was submitted to the Health Research Ethics Board at the University of Alberta and received ethical clearance (Appendix J). It was also submitted to WestView Health Center for health care agency review and a letter of support and/or permission to access respondents and their records was obtained prior to initiation of participant selection and data collection.

Voluntary informed consent was obtained by the researcher from research participants meeting inclusion criteria, prior to collection of data. The researcher obtained written consent once the study participant had given verbal agreement to participate and had reviewed the study information note (Appendix A). Study participants were made aware that they could withdraw from the data collection procedure at any time and that these withdrawals would not affect their subsequent treatment in the CCC setting.

The Health History and Lower Limb Assessment Form Data collection tool was labeled with information consistent with other forms on the subject's chart and for the purposes of this study, was assigned a sequential number allocation starting with 1a (PWD without lower limb ulceration) and 1b (PWD with lower limb ulceration). This completed document became part of the subject's permanent chart. A photocopy of this data was made, omitting any personal identifying information and leaving only the previously allocated study number. The three study questionnaires were only marked with the subject's allocated study number to ensure that multiple questionnaires for each participant were kept together. These questionnaires, along with the photocopy of the Health History and Lower Limb Assessment Form, became part of the study data and were accessible only to the researcher. Data was maintained in a locked cabinet at the researcher's home office at WVHC, Stony Plain until sample size was reached. It was the researcher's responsibility to obtain, manage and analyze all data collected. Study data will be kept for a minimum of seven years.

Half of the study participants had some form of lower extremity ulceration, therefore CCC management of participants continued following the study's conclusion.

As a result, some study participants required the professional services of the researcher as part of their usual care. The researcher ensured that no reference to the study was made in follow-up care.

Chapter 4: Results

In this chapter the Ulcer and No Ulcer groups are described with both demographic and clinical similarities and differences explored. The results of self foot-care knowledge, practice and self-efficacy surveys are also contrasted and compared, with the results of the analyses utilized to address the null hypotheses posed by the study research questions.

Sample

Thirty four eligible participants presented to CCC at WVHC between December 2006 and February 2007. All but two (93%) gave their informed, written consent for participation in the study. These two verbally agreed to participate upon first contact with the researcher, but failed to present for data collection and survey completion on the scheduled date. An alternate meeting was offered, but neither participant was able to attend, and so were not included in the study. In total sixteen PWD without lower limb ulceration and sixteen PWD with lower limb ulceration consented to participate. Each participant had a complete data set and met all inclusion criteria.

Demographic Characteristics

Thirty two participants ranging in age from age 44-78 years of age participated in the study. They were divided into two groups: the No Ulcer Group (44-75 years of age) and the Ulcer Group (44-78 years of age). Demographic characteristics of each group are provided in Table 1. Results of chi-square analyses showed that there was a statistically significant difference between the Ulcer and No Ulcer Groups in: mean age, gender and history of previous lower limb ulceration. The Ulcer Group was significantly older than the No Ulcer Group [$t(30) = 2.33$, $p = .026$]. Not only were participants in the

Ulcer group older, but there were also more men (70.6%) than women (26.7%) in the Ulcer Group [$\chi^2(1, N = 32) = 6.15, p = .013$]. More participants in the Ulcer Group (68.8%) also had a previous leg ulcer compared to the No Ulcer group (12.5%) [$\chi^2(1, N = 32) = 10.49, p = .001$]. There were no significant differences between groups in glycemic control, years since diabetes diagnosis, glycemic education or smoking history.

Table 1.

Demographic Characteristics of Ulcer & No Ulcer Groups

Demographic Characteristic	No Ulcer n=16		Ulcer n=16		p
	M	SD	M	SD	
Mean age (SD)	57	9.2	65	10.0	.026
	f	%	f	%	
Male f (%)	5	29.4	12	70.6	.013
Female f (%)	11	73.3	4	26.7	
Hyperglycemic control					.446
Insulin dependent	6	37.5	4	25.0	
Non-insulin dependent	10	62.5	12	75.0	
Mean years since diagnosis f(%)					.264
5-10 years	8	50.0	4	25.0	
>10 years	4	25.0	8	50.0	
Glycemic education					.310
>1-5 years ago f(%)	4	25.0	5	31.3	
>5 years ago f (%)	8	50.0	6	37.5	
Smoking history f (%)					.662
Never smoked	8	50.0	7	43.8	
Smoked but quit >1 year	6	37.5	5	31.3	
Previous leg ulcer f(%)	2	12.5	11	68.8	.001

Clinical Characteristics

There were significant differences between the No Ulcer and the Ulcer Groups in the areas of skin condition, presence of foot deformities, toenail length, provider of nail care, and footwear condition and fit (Table 2). Because all participants had diabetes, they were all considered to have skin at risk of ulceration. All participants in the Ulcer

Group had skin at further risk of ulceration (presence of dryness, callous, corns, moisture, maceration, fissures or erythema) [$\chi^2(1, N = 32) = 8.96, p = .003$] compared to the No Ulcer Group (56.3%). In addition, significantly more participants in the Ulcer Group (93.8%) compared to the No Ulcer Group (18.8%) had one or more foot deformities [$\chi^2(1, N = 32) = 18.29, p = .000$]. Participants in the Ulcer Group (43.8%) were more likely to display improper toenail length compared to the No Ulcer Group (6.3) [$\chi^2(1, N = 32) = 6.00, p = .014$]. However, more participants in the Ulcer Group (37.5%) than in the No Ulcer Group (18.7%) relied on either non-professional or professional assistance for toenail podiatry [$\chi^2(2, N = 32) = 6.53, p = .038$]. Participants in the Ulcer Group (43.8%) were also more likely than the Ulcer Group (6.3%) to have footwear in improper condition [$\chi^2(1 N = 32) = 6.00, p = .014$]. Finally, 68.8% of those in the Ulcer Group compared to 18.8% of participants in the No Ulcer Group had improperly fitting footwear [$\chi^2(1, N = 32) = 8.13, p = .004$].

Table 2.

Clinical Characteristics of Ulcer and No Ulcer Groups

Clinical Characteristic	No Ulcer n=16		Ulcer n=16		p
	f	%	f	%	
Skin of feet at risk	9	56.3	16	100	.003
Foot deformity (1 or >)	3	18.8	15	93.8	.000
Toenail length improper (too long)	1	6.3	4	43.8	.014
Toenail care not by self (professional or nonprofessional)	3	18.7	6	37.5	.038
Footwear in improper condition	1	6.3	7	43.8	.014
Footwear does not fit properly	3	18.8	11	68.8	.004

Participants in the Ulcer Group were further evaluated by having their lower extremity wounds classified according to the University of Texas Health Science Center, San Antonio Diabetic Wound Classification System, as recommended in the RNAO nursing best practice guidelines (RNAO, 2005). The majority of these participants (62.5%) had superficial wounds not involving tendon, capsule or bone. Equal numbers (12.5%) had either wounds penetrating to the bone or joint with infection, or had wounds completely epithelialized with ischemia present. Small numbers (6.3%) had deep wounds penetrating to the tendon or capsule or had wounds completely epithelialized with clinical infection.

All of the Ulcer Group had some degree of peripheral neuropathy (determined by mono-filament testing on both feet) compared to only 25% of the No Ulcer Group. All of the No Ulcer Group and 87.5% of the Ulcer group demonstrated adequate peripheral vascular supply as evidenced by ABPI >.8mmHg and toe systolic pressure >45mmHg. Only two participants (12.5%) from the Ulcer Group had ABPI <.8mmHg and toe systolic pressures < 45mmHg indicating significant peripheral ischemia to at least one leg. A traumatic event preceded development of a lower extremity wound in 62.5% of the Ulcer Group. Interestingly, the remaining 37.5% of participants who did not have a lower extremity wound related to a traumatic onset, also presented with clinical evidence of chronic venous stasis disease, which is significant ($p=.003$) and has implications for ulcer development..

Foot-Care Knowledge

Foot-care knowledge refers to what participants know that they should do to take care of their feet. Participants were asked to respond to seven questions (Table 3) related

to self foot-care knowledge. There were no significant differences [t(30) = .946, p = .352] on foot-care knowledge scores between the Ulcer and No Ulcer Groups. Correct responses for participants in the No Ulcer Group ranged from two to seven out of a possible seven (M = 6.0; SD 1.3), while the range for participants in the Ulcer Group ranged from four to seven (M = 5.6, SD .89). Overall, foot-care knowledge was considered to be more than adequate and comparable between groups even though the range of scores for the Ulcer Group was somewhat higher. While there was not a statistically significant difference between the Ulcer and No Ulcer Groups, the knowledge question with the least number of correct responses related to the type of shoes to wear, with 43.8% of the No Ulcer and 25% of the Ulcer Group incorrectly identifying the type of footwear that PWD should wear.

Table 3.

Foot-Care Knowledge Questionnaire Results

Question	Correct Response	No Ulcer n=16		Ulcer n=16		p
		f	%	f	%	
1. I should look at my feet carefully:	Every day.	15	93.8	16	100	.310
2. If the skin on my feet is dry or rough, I should:	I use a lotion to moisten it.	15	93.8	15	93.8	1.00
3. I should wash my feet in:	Warm water.	15	93.8	15	93.8	1.00
4. I should dry my feet:	Thoroughly, with a towel.	16	100	14	87.5	.144
5. I should wear:	Hard shoes to protect my feet.	7	43.8	4	25.0	.264
6. I should wear socks and shoes:	All the time, except in bed.	14	87.5	14	87.5	1.00
7. If I get a blister or foot sore. I should:	I let my doctor know immediately	14	87.5	12	75.0	.365

Foot-Care Practice

Foot-care practice refers to what participants actually do, rather than what they should do with respect to caring for their feet. Participants were asked to respond to seven questions related to foot-care practice (Table 4). Correct responses for the No Ulcer Group ranged from one to seven out of a possible seven (M = 4.3, SD 1.9) while the range for the Ulcer Group ranged from four to seven (M = 5.3, SD .90). There were significant differences between the Ulcer and No Ulcer Groups in the areas of inspecting feet [$\chi^2(1, N = 32) = 6.79, p = .009$] and wearing shoes and socks when they should [$\chi^2(1, N = 32) = 4.80, p = .028$]. While only 43.8% of the No Ulcer Group reported that they look at their feet every day, 87.5% of the Ulcer Group reported that they correctly engaged in this behavior ($p = .009$). Similarly, while only 43.8% of the No Ulcer Group report that they wear socks and shoes every day (except in bed), 81.3% of the Ulcer Group reported that they do so ($p = .028$). Group differences approach significance [$\chi^2(1, N = 32) = 3.31, p = .069$] with respect to washing their feet in warm water. While all of the Ulcer Group indicated that they wash their feet in warm water, 81.3% of the No Ulcer Group adheres to the same regime. An independent two-tailed t-test was done between participant groups. Levene's test for equality of variances was significant ($p < .05$) therefore equal variances were not assumed. Group differences on foot-care practice total scores approached the level of significance [$t(21.7) = 1.96, p = .063$] with the Ulcer Group scoring somewhat higher on total foot-care practice scores than the No Ulcer Group.

Table 4.

Foot-Care Practice Questionnaire Summary

Question	Correct Answer	No Ulcer n=16		Ulcer n=16		p
		f	%	f	%	
1. I look at my feet carefully:	Every day.	7	43.8	14	87.5	.009
2. If the skin on my feet is dry or rough:	I use a lotion to moisten it.	15	93.8	16	100	.310
3. I wash my feet in:	Warm water.	13	81.3	16	100	.069
4. I dry my feet:	Thoroughly, with a towel.	15	93.8	14	87.5	.544
5. I wear:	Hard shoes to protect my feet.	3	18.8	3	18.8	1.00
6. I wear socks and shoes:	All the time, except in bed.	7	43.8	13	81.3	.028
7. If I get a blister or foot sore, I:	Let my doctor know immediately.	8	50.0	9	56.3	.723

Foot-Care Self-Efficacy

Results of group comparisons on foot-care self-efficacy are provided in Table 5. The only significant difference between participating groups was with respect to confidence in wearing socks and shoes [$\chi^2(4, N = 32) = 9.61, p = .047$]. Fewer participants in the No Ulcer Group (56.3%) were confident in knowing when to wear socks and shoes when they should, compared to the Ulcer Group (93.8%). An independent t-test was done between participant groups. Levene's test for equality of variances was not significant ($p > .05$) therefore equal variances were assumed. While the two groups differ with regard to wearing socks and shoes when they should, there

were no statistically significant overall differences in foot-care self-efficacy scores between the No Ulcer and Ulcer Groups [$t(30) = 1.52$, $p = .138$].

Table 5.

Foot-Care Self-Efficacy Questionnaire Summary

Question	Strongly agree/agree		Slightly agree/ slightly disagree		Disagree/ Strongly Disagree		p
	No ulcer f(%)	Ulcer f(%)	No ulcer f(%)	Ulcer f(%)	No ulcer f(%)	Ulcer f(%)	
1. I am confident in my ability to look at my feet on a regular basis.	14(87.5)	14(87.5)	2(12.5)	2(12.5)			.590
2. I am sure what to do when the skin on my feet is dry or rough.	13(81.3)	14(87.5)	3(18.8)	2(12.5)			.441
3. I am sure of my ability to safely wash my feet.	14(87.5)	16(100)	2(12.5)				.350
4. I am sure that I dry my feet in the best way.	15(93.8)	15(93.8)	1(6.3)	1(6.3)			.545
5. I am confident that I wear the correct type of shoes.	11(68.8)	14(87.5)	4(25)	2(12.5)	1(6.3)		.406
6. I am sure that I always wear shoes and socks when I should	9(56.3)	15(93.8)	1(6.3)	1(6.3)	6(37.5)		.047
7. I am confident that I know when to talk to my doctor about problems with my feet.	16(100)	15(93.8)		1(6.3)			.086

In summary, the two study groups differed by gender with significantly more men than women in the Ulcer Group, when compared to the No Ulcer Group. No significant gender differences were found, except in the case of foot-care self-efficacy, in which 86.2% of men strongly agreed or agreed that they always wore shoes and socks when they should, compared to 60% of women ($p = .021$). Study participants differed across a number of clinical characteristics. While all participants in the Ulcer Group had skin at risk on their feet, 56.3% of the No Ulcer Group also had skin at risk

(p=.003). In addition, more participants in the Ulcer Group had toenails of improper length (43.8%; p = .014), footwear in improper condition (43.8%; p = .014) and footwear that fit improperly (68.8%; p = .004).

The University of Texas Health Science Center San Antonio Diabetic Wound Classification was completed for all participants to give a comprehensive baseline assessment of participants with wounds. There were no statistically significant differences between the Ulcer and No Ulcer Groups on Foot-Care Knowledge [t(30) = .946. p = .352] or Foot-Care Self Efficacy Questionnaires [t(30) = 1.52, p = .138]. However, differences in Foot-Care Practice Questionnaire scores approached the level of significance [t(21.7) = 1.96, p =.064] indicating the Ulcer Group had somewhat higher foot-care practice scores than the No Ulcer Group.

Chapter 5: Discussion

The purpose of this study was to describe and compare foot-care knowledge, foot-care practices and self-efficacy in performing foot-care in two subsets of individuals with type 2 diabetes; one with lower limb ulceration and one without. Three research questions were addressed: 1) Do PWD with and without lower limb ulceration differ on their self foot-care knowledge? 2) Do PWD with and without lower limb ulceration differ on self foot-care practice? 3) Do PWD with and without lower limb ulceration differ on self-efficacy in performing self foot-care?

In this chapter the results of the study are interpreted in terms of the previous literature and the study design. The demographic and clinical characteristics of the sample in each of the subsets are discussed followed by an interpretation of the results and of the analyses used to address the three research questions. Study limitations and the implications for future practice and research are presented.

The Study Sample

Demographically, study participants in the Ulcer and No Ulcer Groups differed significantly with regard to gender and age. This finding was congruent with the results of a number of previous studies showing a relationship between age and gender of PWD with lower limb ulceration (Campbell et. al., 2000; Marston & Dermagraft Diabetic Foot Ulcer Study,Group, 2006; Nabuurs-Franssen, Huijberts, Nieuwenhuijzen Kruseman, Willems, & Schaper, 2005; Plummer & Albert, 1995; Reiber, Lipsky, & Gibbons, 1998; Ribu, Hanestad, Moum, Birkeland, & Rustoen, 2007). In terms of gender, differences in beliefs about health and illness between men and women may affect self care (Hjelm, Nyberg & Apelqvist, 2002), with women being more likely to engage in self foot-care

activities (Bell et. al., 2005). Women are usually more motivated in preventative and self care, while men show a more passive attitude and rely more heavily complementary care (lay and professional) (Hamalainen et. al., 1998). Older men with diabetes, living alone, have also been identified as having a higher incidence of foot ulceration (Ribu, et. al., 2006; Wrobel, J. S., Robbins, J. M., Charns, M. P., Bonacker, K. M., Reiber, G. E., & Pogach, L., 2006). In terms of age, diabetic foot complications increase three-fold in ages 45-74 years and seven-fold in PWD over 75 years (Campbell, et. al., 2000). In a review of related literature, many studies identified neither age nor gender as significant indicators of ulcer incidence (Abbott, Vileikyte, Williamson, Carrington, & Boulton, 1998; Campbell, et. al., 2004; Frykberg, 1999; Vileikyte, Peyrot, Bundy, Rubin, Leventhal, Mora, et. al., 2003) even though sample demographics show that a trend exists in the data collected. Reasons for this are unclear. Even though sample size of this study is small, age and particularly gender differences were significant between the Ulcer and the No Ulcer Groups. While age and gender were not the focus of this study, findings suggest that this is an area which may influence future health care management of PWD with lower limb ulceration, thereby warranting future investigation into the true nature of this trend.

Clinically, the Ulcer Group demonstrated significantly higher foot risk than the No Ulcer Group. All of the Ulcer Group had skin at risk on their feet, in addition to having an ulcer present; however a large proportion of the No Ulcer Group also had skin at risk on their feet. This puts these participants at a higher risk for also developing a foot ulcer. Comparatively, in Corbett's (2003) population of PWD without ulceration,

75% of subjects had one or more risk factors for development of lower extremity ulcers suggesting that skin ulcer risk is significantly high across the population of PWD.

Toenails were of improper length (too long) in 43.8% of the participants in the Ulcer Group compared to only 6.3% of the No Ulcer Group. While this is not identified as a theme in related literature, inappropriate toenail care has been identified as one of the most common foot-care behavior deficits among PWD (Plummer & Albert, 1995). In this study, more participants in the Ulcer Group had their nails cut by others (professional or non-professional) than did the No Ulcer Group. Extended length of time between pedicure, possibly due to cost and access to assistance, may offer some explanation, however further research is required to confirm this hypothesis. An even higher proportion of PWD (61%) were identified with improper toe nail length (too long) in Corbett's (2003) study of PWD without ulceration. Proper toe nail podiatry has been identified as an important aspect of foot-care for PWD (RNAO, 2004).

The Ulcer Group wore improperly fitting footwear 68.8% of the time, and their footwear was in poor condition 43.8% of the time. This is significant because ill-fitting shoes are instrumental in the development of callus, blisters and corns which can lead to ulceration and prolonged wound healing times in PWD (RNA, 2005). This poses a risk to the 18.8% of the No Ulcer Group that also had improperly fitting footwear, particularly those with skin at risk on their feet. This is also an issue with PWD with foot deformities or PWD who have had previous leg ulcers. Inappropriate footwear was also identified in 49% of PWD without ulceration in Corbett's (2003) study, though direct sample comparison cannot be made, as method of evaluation was different. Even though this was a small, nonrandom, convenience study, results support findings in the literature

that emphasize that the most common offending cause of traumatic foot ulceration is ill fitting footwear (RNAO, 2004; RNAO, 2005; Lavery, et. al., 1998).

Structural deformities were present in 93.8% of the Ulcer Group with 68% having had a previous leg ulcer. The University of Texas Foot Classification for all study subjects revealed that all participants in the Ulcer Group had some degree of peripheral neuropathy compared to only 25% of the No Ulcer Group. In addition, 62.5% of the Ulcer Group had had a traumatic wound onset. Canadian literature shows that the triad of deformity, neuropathy and trauma is present in almost two thirds of clients with lower extremity ulcerations (RNAO, 2005). This is more than demonstrated in the Ulcer Group. Interestingly, of the six participants in the Ulcer Group that did not have a trauma related wound, all but one also had chronic venous stasis as co morbidity (80%). In these cases, it is plausible that lower extremity ulceration may have been related to venous stasis disease. The consideration of mixed etiology causation is important in guiding wound management strategies and in the prevention of lower extremity complications in PWD.

The lower limb ulcers of PWD in the study were graded according to the University to of Texas Health Science Center San Antonio Diabetic Wound Classification to determine severity of wounds (Lavery, et. al., 1998). Most wounds (62.5%) were superficial in nature and did not involve tendon, capsule or bone and demonstrated a good propensity for healing. Grading of wounds with a reliable, Canadian recommended tool such as the one mentioned prior, provides a consistent method of assessment and comparison between individuals and groups and facilitates evaluation of client outcomes (RNAO, 2005). Consideration of wound grade is also

important in planning effective wound management strategies and in predicting the severity of lower limb complications such as amputation.

The Question of Self Foot-Care Knowledge

Do PWD with and without lower limb ulceration differ on their self foot-care knowledge? Study results demonstrated that there were no significant differences between the Ulcer and the No Ulcer Groups overall knowledge scores which support the null hypothesis of this research question. The clinical evidence however, demonstrates that there are significant differences between what each group says they know regarding self foot-care and what clinical observations were made by the researcher, reflecting self foot-care practice. Therefore, specific questions from the questionnaire are discussed to highlight significant group differences in specific areas of self foot-care knowledge.

The knowledge question with the lowest frequency of correct answers was related to *wearing hard shoes to protect my feet*. While there was not a statistically significant difference in question scores, both groups had a lower than optimal frequency of correct answers, with the No Ulcer Group correctly answering the question 43.8% of the time and the Ulcer Group correctly answering only 25% of the time. Significant clinical differences between the two groups were observed by the researcher however, with regard to footwear fit ($p = .004$), and to condition of footwear worn ($p = .014$). While 68.8% of participants in the Ulcer Group had improperly fitting shoes, only 18.8% of the No Ulcer Group did so. In addition, the Ulcer Group also had footwear in poor condition 43.8% of the time compared to only 6.3% of the time in the No Ulcer Group. This is consistent with Corbett's findings in a(2003) population of PWD without

ulceration, where the footwear question was answered with the least frequency of correct answers.

Literature suggests that knowledge does not necessarily translate into behavior change. Indeed, PWD are exposed to a lot of self-care information. However, self foot-care knowledge without behavior change does not prevent lower leg ulceration. Alternately, differences that actually exist between PWD with and without lower leg ulceration may not accurately represent the population of PWD as a whole due to the small, nonrandom, convenience sample.

The Question of Self Foot-Care Practice

Do PWD with and without lower limb ulceration differ on self foot-care practice? While this may not be enough to reject the null hypotheses, group comparisons on mean total scores for self foot-care practice approached a significant difference between the Ulcer and No Ulcer groups on self foot-care practice, suggesting there was somewhat of a difference between the self foot-care practices of the Ulcer Group and the No Ulcer Group. Even though practice between the two groups may not actually have differed greatly on the whole, there was a higher frequency of correct responses among the Ulcer group in five of the seven questions in the questionnaire.

The self foot-care question with the lowest frequency of correct responses involved *wearing shoes to protect feet.* Both study groups had a low frequency of correct responses with only 18.8% of respondents in each group answering the question correctly. This may have involved wording of the question which asked respondents if they should wear "normal shoes", just like any one else; extra wide, extra big shoes; hard shoes to protect feet; or open shoes to let my toes "breathe". According to Canadian

CPG, PWD are commonly asked to purchase hard shoes to protect their feet, that are not too narrow in the arch (RNAO, 2004) and that have an extra wide, extra deep toe box (RNAO, 2005). There was the possibility that participants were unclear with their interpretation of extra wide, extra big; as compared to extra wide, extra deep. A revision to response options on the questionnaire for this question may be warranted in future, clarifying correct footwear in accordance with RNAO guidelines (as above). While results are viewed with caution, they showed a negative trend for both groups, with regard to the type of footwear chosen, which is consistent with results of the self foot-care knowledge question pertaining to footwear type. This is of particular interest as clinical assessment of footwear demonstrated that the Ulcer Group had significantly more participants (68.8%) with improperly fitting footwear compared to the No Ulcer Group (18.8%). This may be related to significantly more participants in the Ulcer Group having foot deformities (93.8%) and toenails that were too long (43.8%), which would make proper footwear fit more difficult. Overall, Corbett (2003) had similar findings in a population of PWD without ulceration in that only 19% of those respondents answered the question regarding type of footwear worn, correctly.

Respondents also had significant differences in scoring on the questions regarding *look at feet every day* ($p = .009$) and *wearing socks and shoes all the time except in bed* ($p = .028$). Eighty seven percent of the Ulcer Group looked at their feet everyday, compared to only 43.8% of the No Ulcer Group. Corbett's (2003) findings in the area of self foot-care practice were similar in that 47% of PWD without ulceration in that study did daily foot examinations. More participants in the Ulcer Group also wore socks and shoes all the time (81.3%) than in the No Ulcer Group. This is contradictory

in that while there were no significant differences in the Ulcer and No Ulcer Groups with regard to self foot-care knowledge regarding when to look at their feet and when to wear socks and footwear, more participants in the Ulcer reported that they actually practiced these behaviors than in the No Ulcer Group. Intuitively, this may be due to over-reporting by the Ulcer Group or due to the fact that by having a wound on their leg, the Ulcer Group has to look their feet daily or have someone else do so as part of ongoing wound management and monitoring. Alternately, self-reporting instruments may not convey accurate differences, particularly in a small, nonrandom study.

The self care practice items associated with the highest frequencies of correct responses for both groups pertained to *moisturizing skin on the feet when it is dry or rough, drying feet thoroughly with a towel* and *washing feet in warm water* with no significant between group differences. Corbett's (2003) study subjects did similarly well with regard to moisturizing skin and washing feet in warm water (89%). Differences between groups approach statistical significance with regard to washing feet in warm water, with the Ulcer Group doing so 100% of the time compared to 81.3% of the time in the No Ulcer Group ($p = .069$). This is also consistent with Corbett's findings (2003) in which the subject population of PWD without ulceration washed their feet in warm water 89% of the time. Again, both the Ulcer and No Ulcer Groups did not significantly differ in their knowledge of appropriate water temperature for washing, however the Ulcer Group reported following through with this practice more often. This may be influenced by a more laid back approach to foot-care by the No Ulcer Group because they didn't have a wound on their leg and had fewer participants with peripheral neuropathy affecting temperature sensation. As well, each participant was left to define

what "warm" was and had to make a individual judgment. Again, over-reporting and small sample size must be considered in discussing study results.

The Question of Foot-Care Self-Efficacy

Do PWD with and without lower limb ulceration differ on self-efficacy in performing self foot-care? Overall self-efficacy scores were not significantly different between the Ulcer and No Ulcer Groups. The question with the lowest rate of correct reponses was with respect to *always wear shoes and socks* when participants should with 93.8% of the Ulcer Group reporting they wore socks and shoes all the time, except in bed, compared to 56.3% of the No Ulcer Group. This was also consistent with Corbett's (2003) findings in which 58% of PWD without ulceration felt confident they wore socks and shoes when they should. While no statistically significant differences were found with regard to confidence in wearing the correct type of shoes, there were a broad range of scores ranging from strongly disagree (least confidence) to strongly agree (most confidence). Of the Ulcer Group, 87.5% were confident in their ability to wear the correct type of shoes, while 68.8% of the No Ulcer Group expressed the same degree of confidence. These findings were again consistent with Corbett's (2003) in which 55% of PWD without ulceration felt confident that they wore the correct type of shoe.

The study findings support the null hypothesis that there were no differences in foot-care self-efficacy between the Ulcer and No Ulcer Groups. However, while participants in both groups demonstrated no overall significant differences in knowledge, analysis of clinical characteristics of participants in the Ulcer Group suggests that they may have over-reported their self foot-care practices in comparison to the No Ulcer Group. It would follow then, that there may also have been over reporting

of confidence or self-efficacy by the Ulcer Group. Reportedly high self-efficacy of the Ulcer Group with regard to fit and condition of footwear was inconsistent with the clinical assessment of footwear and fit done by the researcher. Alternately overall difference between the Ulcer and No Ulcer Group may indeed exist, but have not been identified in this small, nonrandom sampling.

Overall Findings

There were no statistically significant differences in overall self foot-care knowledge or self-efficacy scores between the Ulcer and No Ulcer Groups, while self foot-care practice scores approached statistical significance. However, individual items relating to footwear were of particular concern with participants in the Ulcer Group reporting higher confidence in type of footwear worn as compared to knowledge and practice responses to footwear inquiries and clinical assessment of participant footwear.

Significantly more participants in the Ulcer Group had improperly fit footwear, in poor condition, compared to the No Ulcer Group. From this, it may be construed that while the Ulcer Group reports a similar degree of self foot-care knowledge, practice and self-efficacy as the No Ulcer Group, they may not consistently put knowledge regarding footwear into practice, though they report that they do. Why has this gap between knowledge, practice and efficacy been found? Why are PWD with lower limb ulceration not putting knowledge into practice? Possibly, the Ulcer Group may find putting footwear knowledge into practice more difficult given the number of participants with deformities of their feet and the number of participants with improper toenail length. As well, the Ulcer Group may under-estimate the importance of properly fit footwear in

good condition while being falsely over-confident with ability to make good footwear choices.

While nail care was not one of the self care items measured with the questionnaires used, significantly more participants in the Ulcer Group presented with improper (too long) toenail length compared to the No Ulcer Group. Nail length may have been a surrogate marker for foot-care practice in Ulcer Groups in that improper toenail length tends may imply PWD are not taking care of their feet and may therefore be more likely to develop lower limb complications. While CPG identified nail care as an important component of foot-care teaching for PWD, a lack of evidence was found regarding nail care knowledge, practice and self-efficacy. Future consideration should be given to the inclusion of nail care items in self care measurement tools.

Recommendations for Future Research

This study was limited by a single-center design and small convenience sample size. The small sample of 32 participants (split into study groups of 16 each) in this study may have increased the chance that the sample would deviate from the defined population's true nature by a certain degree; therefore results of the study are viewed with some caution. However, this description of self foot-care knowledge, practice and self-efficacy of PWD with and without ulceration offers some insight into self foot-care behavior. Findings warrant further descriptive and investigational research into self foot-care and into strategies to enhance transfer of self foot-care knowledge into confident self care practice.

Footwear of PWD with lower limb ulceration was identified as an area of particular concern with regard to self foot-care knowledge and practice, with confidence

overstated in relation to clinical assessment of footwear in this group. Improper nail care was also identified as significant in PWD with lower limb ulceration, though related knowledge, practice and self-efficacy were not measured. Is nail length truly a surrogate marker for foot-care and does it correlate with improper footwear? Study results suggest the need for further investigation.

A number of other areas for future research were identified in this study. Significantly more men than women presented with lower limb ulceration and the Ulcer Group was significantly older. There is some evidence in the literature to support that this is indeed a trend in PWD with lower limb ulceration although further investigation is needed to support this finding. Do gender and/or age truly influence the self foot-care knowledge, practice and self-efficacy of PWD with lower limb ulceration? And if so, what strategies might health care professionals employ to support and facilitate self foot-care knowledge, practice and self-efficacy in specific populations of PWD with lower ulceration(i.e. older, men) , so that positive health outcomes and better complication management may be realized?

Limitations of the Study

It is highly possible that self foot-care practices are different in the summer months (wear shoes less) versus the colder months of the year (wear shoes more, skin drier). Data was collected for this study in the winter months of December to February. Given that data was collected during the coldest time of year in this geographical area, skin condition (dryness), type of footwear worn (winter boots, closed toe shoes) and the amount of time spent wearing footwear (worn more) may be skewed. While correctly fitting footwear in proper condition is always of great importance to PWD, the necessity

for numerous type of footwear, including footwear for snow and slush, may make proper footwear choices more difficult.

Comparisons between Corbett's American study of PWD without lower limb ulceration and this study have been made. While results in both study populations of PWD without ulceration were similar, should they have been? Corbett's sample was comprised of home-care clients, implying that participants were of a socio-economic group able to access American pay-for-service system. This might make them similar or different from this study group. Geographically, participants of this study were sampled during the coldest portion of the winter months, while Corbett's sample resides in an area with similar seasons of the year, the time of year is not identified in Corbett's study. Additionally, Corbett's sample may have had more health care needs, given that they required homecare services, but did not have lower limb ulceration for which they required service. Therefore; comparisons between Corbett's study results and results of this study must be viewed with caution.

Some study participants were already attending CCC for complex wound management prior to study participation. While there was no formal foot-care education at CCC, study participants may have been subjected to some degree of informal self foot-care education as part of their treatment, which may have influenced their self foot-care knowledge, practice and self-efficacy to some degree. Also, participants attending the CCC may over report self foot-care practice and self-efficacy to please professional staff and give the "right answer".

Alternately, the method of questionnaire administration may have affected study results. Self foot-care knowledge, then practice, then self-efficacy questionnaires were

administered in that order. It is plausible that the correct answer was reinforced with each questionnaire, so participants were more likely to give the correct response with each subsequent questionnaire completed. The study results might have been different if questionnaires were administered in a random order.

Conclusion

Lower limb ulceration and amputation are devastating complications of diabetes. A focus on long-term complication prevention versus acute complication reduction and management is fundamental to making long-term changes to outcomes. Describing what it is that PWD know and do with regards to self foot-care, along with how confident they are in doing so, is essential to determining how best to empower PWD, support self foot-care behaviors and prevent lower extremity complications. Validation of existing tools in a variety of populations is important to providing consistent, reliable methods of measure. Comparing self foot-care knowledge, practice and self-efficacy of populations of PWD with and without foot ulceration has allowed prediction of some strength of relationships between participant variables. In doing so, some insight was gained into what the differences between PWD with and without ulceration with regard to self foot-care knowledge, practice and self-efficacy.

PWD and lower limb ulceration are often referred to specialized wound clinics for management interventions and care planning related to wound healing. Wound management and healing often occurs over extended periods of time, in which PWD have repeated contact with health practitioners in a number of settings. A secondary outcome of this research may be to provide future direction into how best build on the self foot-care knowledge, practice and self-efficacy behaviors of PWD, while taking

advantage of the opportunity presented during the repeated contacts required with health practitioner during wound healing.

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Appendix A

FOOT-CARE KNOWLEDGE QUESTIONNAIRE
STUDY ID: _____
DATE: Day____ Month_____ Year_____

Please answer the next seven questions by saying how you **should** take care of your feet. If you have bandages on one foot, please say how you **should** take care of your other foot.

1. I **should** look at my feet carefully:
- **A.** Every day
- **B.** A few times a week
- **C.** Once a week
- **D.** A few times a month
- **E.** I don't look at my feet carefully

2. If the skin on my feet is dry or rough, I **should:**
- **A.** Not worry about it
- **B.** Peel it off
- **C.** Use a lotion to moisten it
- **D.** Tell my doctor

3. I **should** wash my feet in:
- **A.** Hot water
- **B.** Warm water
- **C.** Cold water
- **D.** I don't wash my feet

4. I **should** dry my feet:
- **A.** Thoroughly, with a towel
- **B.** With a towel except between the toes
- **C.** By using powder or corn starch
- **D.** I let my feet dry by themselves
- **E.** I don't wash my feet

5. I **should** wear:
- **A.** "Normal" shoes, just like anyone else
- **B.** Extra wide, extra big shoes
- **C.** Hard shoes to protect my feet
- **D.** Open shoes to let my toes "breathe"

6. I **should** wear socks and shoes:
- **A.** All the time, except in bed
- **B.** Only outdoors, not in the house
- **C.** Only when the weather is cold
- **D.** Only when I go out in public

7. If I get a blister or foot sore, I **should:**
- **A.** Not worry about it
- **B.** Keep it clean and dry and open
- **C.** Cover it up with a dressing
- **D.** Let my doctor know immediately

Appendix B

FOOT-CARE PRACTICE QUESTIONNAIRE
STUDY ID:_____
DATE: Day____ Month _____ Year _____

Please answer these seven questions by saying how you take care of your feet. If you have bandages on one foot, please say how you take care of the other foot.

1. I look at my feet carefully:
- **A.** Every day
- **B.** A few times a week
- **C.** Once a week
- **D.** A few times a month
- **E.** I don't look at my feet carefully

2. If the skin on my feet is dry or rough,
- **A.** I don't worry about it
- **B.** I peel it off
- **C.** I use a lotion to moisten it
- **D.** I tell my doctor

3. I wash my feet in:
- **A.** Hot water
- **B.** Warm water
- **C.** Cold water
- **D.** I don't wash my feet

4. I dry my feet:
- **A.** Thoroughly, with a towel
- **B.** With a towel except between the toes
- **C.** By using powder or corn starch
- **D.** I let my feet dry by themselves
- **E.** I don't wash my feet

5. I wear:
- **A.** "Normal" shoes, just like anyone else
- **B.** Extra wide, extra big shoes
- **C.** Hard shoes to protect my feet
- **D.** Open shoes to let my toes "breathe"

6. I wear socks and shoes:
- **A.** All the time, except in bed
- **B.** Only outdoors, not in the house
- **C.** Only when the weather is cold
- **D.** Only when I go out in public

7. If I get a blister or foot sore, I
- **A.** Don't worry about it
- **B.** Keep it clean and dry and open
- **C.** Cover it up with a dressing
- **D.** Let my doctor know immediately

Appendix C

FOOT-CARE SELF-EFFICACY QUESTIONNAIRE © STUDY ID:_____

DATE: Day___ Month___ Year_____

Please answer the next seven questions by saying how strongly you agree or disagree with the statement about taking care of your feet. If you have bandages on one of your feet, please think about and refer to your foot that is not bandaged.

1. I am **confident** in my ability to look at my feet on a regular basis.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

2. I am **not sure** what to do when the skin on my feet is dry or rough.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

3. I am **not sure** of my ability to safely wash my feet.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

4. I am **sure** that I dry my feet in the best way.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

5. I am **confident** that I wear the correct type of shoes.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

6. I am **not sure** that I always wear shoes and socks when I should.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

7. I am **confident** that I know when to talk to my doctor about problems with my feet.

A. Strongly Agree
B. Agree
C. Slightly Agree
D. Slightly Disagree
E. Disagree
F. Strongly Disagree

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Appendix D

Participant ID#_____
Date:_____

Health History & Lower Limb Assessment Form

Type 2 Diabetes: Time since diagnosis_____

Allergies: _____ **Height**_____ **Weight**_____

Family Physician: yes___ no___ Last visit:_____
Reason:_____

Previous Diabetes Education:
Glycemic control: yes___ no___ when_____ by whom_____
Diet/nutrition: yes___ no___ when_____ by whom _____
Healthy Lifestyle: yes___ no___ when_____ by whom_____
Foot-care: yes___ no___ when_____ by whom_____

Living Arrangements: Alone___ Spouse/Significant Other___ Family Member(s)___
Other_____

Past Medical History:
HTN___ Smoker: ____*/day x* ____*yrs never*____ *quit x* ____*yrs*
Renal impairment___ Other: _____
Retinopathy___ _____
Previous leg ulcer___ _____

Family Medical History:
HTN___ Leg Ulcers___
Diabetes___ Other_____
Osteoporosis___ _____

Past Surgical History:
Amputation yes___ no___
site/when_____
Other: _____
_____

Medication History: *(list or attach)*
_____
_____
_____

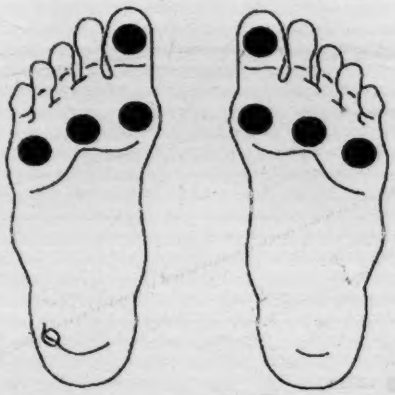
Participant ID#_____

Foot Assessment:	**Right**	**Left**
Color: *pallor(elevation), rubor (depend), mottled*	R_____	L_____
Pulses *(palpable or audible)*: dorsalis:	R_____	L_____
post tibial:	R_____	L_____
Temperature: *h=hot w=warm c=cool*	R_____	L_____
Capillary refill: *≤5 seconds*	R_____	L_____
Edema: *p=pitting np=non-pitting*	R_____	L_____
Claudication: *calf pain with walking yes/no*	R_____	L_____

Neuropathy:

Using 10g monofilament as per RNAO guidelines (RNAO, 2005)

X *over site=absent*



**loss of protective sensation= absent sensation in 1 or more sites*

R_____ L_____

Skin:	**Describe:**	
Calluses:	R_____	L_____
Corns:	R_____	L_____
Dry:	R_____	L_____
Erythema:	R_____	L_____
Fissures:	R_____	L_____
Maceration:	R_____	L_____
Moist:	R_____	L_____
Lesions:	R_____	L_____

Toenails:

Hygiene: *P = Proper I = Improper* R_____ L_____

Length: *P = Proper I = Improper* R_____ L_____

Nail Care: self___ family/friend___ podiatrist___ other (specify)_____

Condition: brittle_____crumbly_____debris_____deformed_____discolored_____
incurvated_____ingrown_____split_____thick cuticles_____
other(specify)_____

Does participant perform self foot-care (other than nail care)? Yes____ No ____
(wash, inspect, doff/don shoes & socks)

Participant ID#_____

Structural deformities:

Halus Valgus/Bunion: *M=mild/moderate S=severe*	R_____	L_____
Hammer Toes:	R_____	L_____
Claw Toes:	R_____	L_____
Pes Planus/Flat arch:	R_____	L_____
Pes Cavus/Abnormally high arch:	R_____	L_____
Charcot:	R_____	L_____
Limited Joint Mobility	R_____	L_____
Other:	R_____	L_____

Footwear:

Condition:	*P=proper*	*I=improper*	R_____	L_____
Fit:	*P=proper*	*I=improper*	R_____	L_____
Socks:	*P=proper*	*I=improper*	R_____	L_____
Pressure Gradient Socks:	*yes*	*no*	R_____	L_____
	P=proper	*I=improper*	R_____	L_____

Vascular Assessment:

Ankle Brachial Pressure Index *(within 6 months)*	R_____	L_____
Toe Pressure *(within 6 months)*	R_____	L_____

University of Texas Foot Classification System Category: *(circle one)*

- ***0:*** *No Pathology*
- ***1:*** *Neuropathy, No Deformity*
- ***2:*** *Neuropathy with Deformity*
- ***3:*** *History of Pathology*
- ***4A:*** *Neuropathic Wound*
- ***4B:*** *Acute Charcot's Joint*
- ***5:*** *Infected Diabetic Foot*
- ***6:*** *Ischemic Limb*

Wound Assessment: ***Total number of wounds:***_____ ***(Measure 3 worst)***
Infection: no___ yes___ (antibiotics: yes___ no___)
(circle) ↑pain / wound breakdown / foul odor / friable granulation

Wound 1: Site_____ Duration of onset_____
Initiating incident_____ Length x Width (cm):_____
Depth (cm): _____ Bone/Tendon/Capsule exposed *(circle)*
Undermining: _____ Tunneling: _____

Wound 2: Site_____ Duration of onset_____
Initiating incident_____ Length x Width (cm):_____
Depth (cm): _____ Bone/Tendon/Capsule exposed *(circle)*
Undermining: _____ Tunneling: _____

Participant ID#_____

Wound 3: Site_____ Duration of onset_____
Initiating incident_____ Length x Width (cm):_____
Depth (cm): _____ Bone/Tendon/Capsule exposed *(circle)*
Undermining: _____ Tunneling: _____

University of Texas Health Science Center San Antonio Diabetic Wound Classification: (*Circle*) *Determine Grade according to worst wound* _____

GRADES

	0	I	II	III
A	Pre-or post-ulcerative lesion	Superficial wound, not involving tendon, capsule, or bone	Wound penetrating to tendon or capsule	Wound penetrating to bone or joint
B	Pre- or post-ulcerative lesion, completely epithelialized with infection	Superficial wound, not involving tendon, capsule, or bone with infection	Wound penetrating to tendon or capsule with infection	Wound penetrating to bone or joint with infection
C	Pre- or post-ulcerative lesion, completely epithelialized with ischemia	Superficial wound, not involving tendon, capsule, or bone with ischemia	Wound penetrating to tendon or capsule with ischemia	Wound penetrating to bone or joint with ischemia
D	Pre- or post-ulcerative lesion, completely epithelialized with infection and ischemia	Superficial wound, not involving tendon, capsule, or bone with infection and ischemia	Wound penetrating to tendon or capsule with infection and ischemia	Wound penetrating to bone or joint with infection and ischemia

Score Summaries: *(researcher will complete)*

Participant ID#_____

Foot-Care Knowledge Score _____

Foot Self Care Score _____

Self-Efficacy Score _____

Foot Classification Score: _____

Wound Classification Grade: _____

Appendix E

University of Texas Foot Classification System – Categories 0-3: Risk Factors for Ulceration

Category 0: No Pathology

- Patient diagnosed with Diabetes Mellitus
- Protective sensation intact
- Ankle Brachial Pressure Index (ABPI) > 0.80 and toe systolic pressure >45 mmHg
- Foot deformity may be present
- No history of ulceration

POSSIBLE TREATMENT FOR CATEGORY 0

- Two to three visits a year to assess neurovascular status, dermal thermometry, and foci of stress
- Possible shoe accommodations
- Patient education

Category 1: Neuropathy, No Deformity

- Protective sensation absent
- Ankle Brachial Pressure Index (ABPI) > 0.80 and toe systolic pressure >45 mmHg
- No history of ulceration
- No history of diabetic neuropathic osteoarthropathy (Charcot's joint)
- No foot deformity

POSSIBLE TREATMENT FOR CATEGORY 1

Same as Category 0 plus:

- Possible shoe gear accommodation (pedorthic/orthotist consultation)
- Quarterly visits to assess shoe gear and monitor for signs of irritation

Category 2: Neuropathy with Deformity

- Protective sensation absent
- Ankle Brachial Pressure Index (ABPI) >0.80 and toe systolic pressure >45 mmHg
- No history of neuropathic ulceration
- No history of Charcot's joint
- Foot deformity present (focus of stress)

POSSIBLE TREATMENT FOR CATEGORY 2

Same as Category 1 plus:

- Pedorthic/orthotist consultation for possible custom molded/extra depth shoe accommodation
- Possible prophylactic surgery to alleviate focus of stress (e.g., correction of hammer toe or bunion deformity)

Category 3: History of Pathology

- Protective sensation absent
- Ankle Brachial Pressure Index (ABPI) >0.80 and toe systolic pressure >45 mmHg
- History of neuropathic ulceration
- History of Charcot's joint
- Foot deformity present (focus of stress)

POSSIBLE TREATMENT OF CATEGORY 3

Same as Category 2 plus:

- Pedorthic/orthotist consultation for custom molded/extra depth shoe accommodation
- Possible prophylactic surgery to alleviate the focus of stress (e.g., correction of bunion or hammer toe)
- More frequent visits may be indicated for monitoring

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University of Texas Foot Classification System – Categories 4-6: Risk Factors for Amputation

Category 4A: Neuropathic Wound

- Protective sensation absent
- Ankle Brachial Pressure Index (ABPI) > 0.80 and toe systolic pressure >45 mmHg
- Foot deformity normally present
- Non-infected neuropathic ulceration (ALL UT* STAGE A wounds)
- No acute diabetic neuropathic osteoarthorpathy (Charcot's joint) present

POSSIBLE TREATMENT FOR CATEGORY 4A

Same as Category 3 plus:

- Pressure reduction program instituted
- Wound care program instituted

Category 4B: Acute Charcot's Joint

- Protective sensation absent
- Ankle Brachial Pressure Index (ABPI) > 0.80 and toe systolic pressure >45 mmHg
- Non-infected neuropathic ulceration may be present
- Diabetic neuropathic osteoarthropathy (Charcot's joint) present

POSSIBLE TREATMENT FOR CATEGORY 4B

- Pressure reduction program instituted
- Thermometric and radiographic monitoring
- If ulcer is present, treatment same as Category 4A

Category 5: The Infected Diabetic Foot

- Protective sensation may or may not be present
- Infected wound
- Charcot's Joint may be present
- ALL UT* STAGE B wounds

POSSIBLE TREATMENT FOR CATEGORY 5

- Debridement of infected, necrotic tissue and/or bone, as indicated
- Possible hospitalization, antibiotic treatment regimen
- Medical management

Category 6: The Ischemic Limb

- Protective sensation may or may not be present
- Ankle Brachial Pressure Index (ABPI) <0.80 and toe systolic pressure <45 mmHg or Pedal Transcutaneous Oxygen Tension < 40 mmHg
- Ulceration may be present
- ALL UT* STAGE C AND D wounds

POSSIBLE TREATMENT OF CATEGORY 6

- Vascular consult, possible revascularization
- If infection present, treatment same as for Category 5. Vascular consultation concomitant with control of sepsis.

Legend: *UT = University of Texas

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Appendix F

University of Texas Health Science Center San Antonio Diabetic Wound Classification System

GRADES

	0	I	II	III
A	Pre-or post-ulcerative lesion	Superficial wound, not involving tendon, capsule, or bone	Wound penetrating to tendon or capsule	Wound penetrating to bone or joint
B	Pre- or post-ulcerative lesion, completely epithelialized with infection	Superficial wound, not involving tendon, capsule, or bone with infection	Wound penetrating to tendon or capsule with infection	Wound penetrating to bone or joint with infection
C	Pre- or post-ulcerative lesion, completely epithelialized with ischemia	Superficial wound, not involving tendon, capsule, or bone with ischemia	Wound penetrating to tendon or capsule with ischemia	Wound penetrating to bone or joint with ischemia
D	Pre- or post-ulcerative lesion, completely epithelialized with infection and ischemia	Superficial wound, not involving tendon, capsule, or bone with infection and ischemia	Wound penetrating to tendon or capsule with infection and ischemia	Wound penetrating to bone or joint with infection and ischemia

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Appendix G

Capital Health

Information Letter

Healthier people in healthier communities

Title of Research Study: Foot Care Knowledge, Practice and Self-Efficacy of People with Type II Diabetes, With and Without Lower Limb Ulceration

Researcher: Michele Suitor BScN, NP, MN(c)
Master's Thesis Project, University of Alberta

Thesis Supervisor: Dr. Beverly Williams RN, PhD
Associate Professor, University of Alberta

There are three purposes for this research study. The first is to describe what people with diabetes know about taking care of their feet. The second is to describe what they do for foot-care. The third is to describe how they feel in taking care of their feet. I will collect information from people with diabetes who have an ulcer on their leg(s). I will also collect information from people with diabetes who do not have an ulcer on their leg(s).

What will you have to do? You will be asked about your health history. Both of your legs will be assessed for circulation, sensation and feeling. If this has been done within the last 6 months, those results will be used. The skin of you feet will be assessed for dryness, cracks, corns, calluses or any deformities. Your health history and assessment will become part of your permanent chart. You will be given 3 questionnaires, with 7 questions each, to complete. You are asked to circle one answer (ranging from strongly agree to strongly disagree). You are free to not answer any of the questions. None of your personal information will be on these questionnaires. You will only be identified by a study number assigned to you. Your completed questionnaires will become part of the study data only.

Will it help? There are no direct personal benefits to participating in this study. However, foot-care is important to maintaining healthy feet and in helping to prevent leg ulcers or sores for people with diabetes. Research in this area may assist in promoting better foot-care in the future.

Will it hurt? I do not know of any discomforts or risks that are part of being in this study.

Can you quit? You may refuse to continue in the study at any point. This will not affect your care in Community Care Clinic or in Community Care (Homecare).

Who will know? I will look at your chart to make a copy of your history and assessment form. Your name will not be on the copy that I take. I will not call you about your answers. This copy will become part of the study. The questionnaires you complete will only be identified by a study number. They will not contain any of your personally identifying information. Your answers will become part of the study only. They will not be kept on you permanent chart. I will store the information you provide in a locked cabinet at WestView Health Center, Stony Plain, for a minimum period of seven years. Your name will never be used in any presentations or publications of the study results. The information gathered for this study may be looked at again in the future to help us answer other study questions. If so, the ethics board will first review the study to ensure the information is used ethically.

Your signature: You will be asked to sign a consent form. This will permit me to include you in this study. By signing the consent form you give permission to the study staff to access any personally identifiable health information, that is under the custody of other health care professionals, as deemed necessary for the conduct of the research.

Do you have more questions? *If you have concerns about your rights as a study participant, you may contact the Patient Relations Office of Capital Health, at 407-1040. This office has no affiliation with the study investigators.*

You may contact me if you have any other questions or concerns:

Michele Suitor BScN, NP MN(C) Telephone Number: 780-968-3681

Appendix H

PERMISSION TO RELEASE HEALTH INFORMATION THAT IDENTIFIES YOU FOR A RESEARCH STUDY

This consent gives permission to WestView Health Center to release your full name and phone number. This information will be used in the following thesis research project:

Foot Care Knowledge, Practice and Self-Efficacy of People with Type II Diabetes, With And Without Lower Limb

Your name and phone number may be used released only to **Michele Suitor BScN, NP MN(C)**

WestView Health Center is required by law to protect your health information. Michele Suitor is also required by law to protect your information. She may not share your information with others without your permission.

WestView Health Center may not refuse to treat you based on whether you sign this permission.

You may change your mind and take back this permission at any time. You will not be able to do this if Michele Suitor has already been given you information. To take back permission, you must write to:

Lisa Rybak, Community Care Manager
WestView Health Center
4405 South Park Drive
Stony Plain, AB T7Z 2M7

This Authorization does not have an expiration date

_____ _____

Signature of Participant Date

_____

Printed Name

Appendix I

Consent Form

Title of Project: Foot Care Knowledge, Practice & Self-Efficacy of People with Type 2 Diabetes, With and Without Lower Limb Ulceration

Investigator: Michele Suitor RN, BScN, NP
Masters in Nursing Student, University of Alberta

Do you understand that you have been asked to be in a research study?	Yes	No
Have you read and received a copy of the information sheet?	Yes	No
Do you understand the benefits and risks involved in taking part in this research study?	Yes	No
Have you been able to ask questions and discuss this study?	Yes	No
Do you understand that you are free to refuse to participate or withdraw from the study at any time? You do not have to give reason and it will not affect your care.	Yes	No
Has the issue of confidentiality been explained to you? Do you understand who will have access to your records, including personally identifiable health information?	Yes	No

This study was explained to me by:_____ Date: _____

I agree to take part in this study.

X_____ _____ _____

Signature of participant **Date** **Printed name**

I believe that the person signing this form understands what is involved in this study and voluntarily agrees to participate.

_____ _____

Signature of Investigator or Designee Date

I give permission to the researcher to keep the information I give indefinitely so that if may be included in future research studies, provided the University Ethics committee approves the research.

X_____ _____ _____

Signature of participant **Date** **Printed name**

_____ _____

Signature of Investigator or Designee Date